

MEMORANDUM

DATE: December 20, 1991

TO: Division of Shellfish Sanitation Staff

FROM: Robert E. Croonenberghs, Ph.D., Director
Division of Shellfish Sanitation

THROUGH: Eric H. Bartsch, P.E., Director
Office of Water Programs

SUBJECT: Shellfish and Crustacea Plants - Procedure - Water Supply –
How to Sample - Private Supplies and Connections
- Noncommunity Waterworks
- Nontransient Noncommunity Waterworks
- Approval of Wells

DELETE WORKING MEMO 164

The purpose of this memo is (i) to provide the correct procedure to be followed when obtaining drinking water samples, (ii) to indicate the sanitarian's responsibility concerning the sampling of private supplies and connections to town supplies (i.e., all plants other than noncommunity supplies), (iii) to provide a simple means of determining whether a plant is a noncommunity or nontransient noncommunity waterworks, and to indicate the responsibility of the sanitarian and the plant owner with respect to the sampling of their supplies (iv) to provide guidance for approving either a new well or an existing well.

The working memo will consist of five sections:

SECTION 1 - HOW TO SAMPLE
SECTION 2 - PRIVATE SUPPLIES AND CONNECTIONS
SECTION 3 - NONCOMMUNITY WATERWORKS
SECTION 4 - NONTRANSIENT NONCOMMUNITY WATERWORKS
SECTION 5 - APPROVAL OF WELLS

SECTION 1 - HOW TO SAMPLE

WHERE TO SAMPLE

It is important to get water samples that reflect the water quality throughout the distribution system. Consideration must be given to the piping network. Note: For this reason, water samples collected directly from the water source (i.e., well) are not acceptable, except when conducting follow-up investigative work.

DO NOT SAMPLE FROM:

1. Locations with separate storage tanks. (e.g. fire system tanks and sprinkler systems)
2. Homes with their own treatment system. (e.g. water softeners, filters, and single home chlorinators)
3. Faucets with aerators, unless the aerators are removed.
4. Faucets with swivel type connections. (e.g. on kitchen sinks)
5. Leaky faucets (valve stems) which allow water to run along the outside of the faucet.
6. Faucets with backflow prevention devices directly attached to the outlet.
7. Hot water faucets.
8. An improperly located faucet (e.g. upside down, too close to the floor).

HOW TO SAMPLE

If the correct sampling procedure is not followed, you may contaminate an otherwise good sample. Carefully follow these steps:

1. Flush the sample faucet briefly, for about 20 seconds.
2. Carefully flame the inside of the tap long enough to evaporate any water that is present, using an alcohol flame, sterno, or some other flaming device (this step is optional but highly recommended). Caution: many faucets contain plastic and/or rubber parts; too much heat can destroy the faucet. If flaming is not used, be sure to flush the line for at least 5 minutes before continuing with Step 3.
3. Adjust the flow to a slow even stream and allow the water to run for 2 to 4 minutes to assure that the water from the tap is flowing from the water main, not the in plant piping.
4. If water from the system is chlorinated, collect a sample and, using the DPD method, analyze for residual chlorine. Record the results on the report form.
5. Use only the sample bottles specifically provide by the Division of Shellfish Sanitation laboratory. They are sterilized and contain sodium thiosulfate (which neutralizes any residual chlorine present) and, therefore, **must not** be rinsed, boiled, or otherwise tampered with. The bottle cap may be loose when you receive the sample: this is normal. If the cap is completely off the bottle, do not use the bottle.

6. Open the sample bottle only at the moment it is to receive the water sample. Be sure to hold the cap in a vertical position with edges downward to prevent contamination from air bacteria. **Do not** put the cap down, and always hold the bottle near the bottom.
7. Keeping the flow at a slow, even stream, fill the bottle just to the shoulder, being sure to leave an air space in the bottle to facilitate dispersion of bacteria during exam. Do not overflow, overfill or decant, and avoid splashing.
8. Immediately replace the cap, making sure that the bottle is tightly closed.
9. Place sample into ice for analysis within 48 hours.

SECTION 2 - PRIVATE SUPPLIES AND CONNECTIONS

REQUIREMENTS OF SANITARIANS THAT SAMPLE PRIVATE SUPPLIES AND CONNECTIONS (TO PUBLIC SUPPLIES)

The sanitarian is to sample monthly.

If coliforms are present, the following steps shall be taken:

1. Initiate the tracking form, (found on page 11).
2. Ask owner if any recent work has been done on the well or pipes then the chlorination process should be started and subsequent steps followed as stated in the well chlorination process. If no work has been done on the well or distribution system, then proceed to the next step.
3. Perform a sanitary survey of the well site to determine if there are any sources of contamination is found it should be eliminated and the well chlorinated as stated in the steps of the well chlorination process and the subsequent steps followed as stated. If no source of contamination is identified then proceed to the next step.
4. Send a copy of the tracking form to the central office attached to the initial unsatisfactory bacteriological analysis form.
5. Take check samples within 48 hours from both the wellhead and from within the plant.
6. If the check samples from the wellhead or from the distribution system has coliforms present based on either the fermentation method or the membrane filter method, then the plant owner should investigate the construction of the well. In some instances especially when the wellhead is buried, it may be necessary for the plant owner to have a plumber or a well driller examine the construction of the well. Some of the construction items that should be checked are the sanitary well seal, the vent screen, the integrity of the well casing, the integrity of the pitless adapter (if one is used), the potential for surface water contamination of the well, and the presence and depth of grout. This list is not meant to be inclusive since other conditions can also affect the water quality of the well.

Indicate the actions taken on the tracking form. If problems are found they should be corrected and the well chlorinated in accordance with the following steps:

WELL CHLORINATION PROCESS

- a. Pour the required amount of Chlorox-type bleach into the well casing based on calculations using the information on the next page.
- b. Turn on all spigots in plant and let water run until one can smell chlorine at all taps.
- c. Turn off each tap as chlorine becomes evident.
- d. Let chlorinated water stand in pipes for a minimum of 24 hours.
- e. Open all taps until chlorine smell is gone.
7. Three consecutive negative samples are needed to reinstate the well to good standing and this should be done within 30 days after water supply becomes unsatisfactory.
8. If after two disinfection treatments the samples at the wellhead still indicate contamination, run the MPN test to see whether a chlorinator can be used to correct the situation (see Appendix A, Attached). If counts are not too high for a chlorinator, **REQUIRE** the installation of a chlorinator or you may recommend the installation of a new well. (Remember, a new well may also have an unacceptable level of coliform bacteria).
9. If samples from the wellhead are negative for the presence of coliform bacteria but samples from within the plant are positive for coliform after 3 disinfection treatments, then the owner shall perform one or both of the following steps:
 - a. Install a chlorinator if the coliform bacteria counts are not too high.
 - b. Make the necessary plumbing alterations to eliminate the source of contamination.

The decision as to whether to choose for the owner to institute either one of the steps or both depends upon which is most likely to provide a correction of the problem.

10. Record all sample results on the tracking form, and once you believe the situation is corrected, indicate (handwritten is acceptable) briefly on the form what was done to correct the situation and why you believe the well and plumbing are now acceptable for use. Indicate on the form the amount of chlorine that was used to disinfect the well. Submit a copy to the supervisor for forwarding to the central office once the situation has been corrected, the three consecutive negative samples have been obtained and the form has been fully completed.

GUIDELINES FOR DETERMINING AMOUNT OF BLEACH NEEDED TO DISINFECT WELL AND ASSOCIATED PLANT PLUMBING

A minimum of 50 mg/l of available chlorine is required for disinfecting a well and the associated plumbing. One gallon of bleach (5.25% sodium hypochlorite) will provide 50 mg/l in 1050 gallons of water the well standpipe and associated plumbing in the plant contain, one needs to roughly estimate the number of feet of each size pipe in the plant. Exact numbers are not needed. Roughly estimate the footage of plumbing and determine its volume. Be sure to account for the volume of all storage and pressure tanks. Since the bleach will not perfectly mix with the water in the well, at least double the amount of bleach calculated as needed; a high concentration of free chlorine will not hurt the pump or plumbing.

Gallons of Water in 100' of Pipe

1/2"	=	1 gallon
1"	=	4 gallons
1.5"	=	9 gallons
2"	=	16 gallons
3"	=	37 gallons
4"	=	65 gallons
5"	=	102 gallons
6"	=	147 gallons
7"	=	200 gallons
8"	=	261 gallons
10"	=	408 gallons
12"	=	588 gallons
16"	=	1045 gallons
20"	=	1632 gallons
24"	=	2350 gallons
30"	=	3672 gallons
36"	=	5288 gallons

Divide the number of gallons of water in the well and plumbing by 1050 gallons to determine the number of gallons of bleach (5.25% sodium hypochlorite) needed to produce 50 mg/l. Then double the amount as a safety factor.

SECTION 3 - NONCOMMUNITY WATERWORKS

DESCRIPTION OF NONCOMMUNITY WATERWORKS

To be a noncommunity waterworks, a plant must have its own well and provide drinking water to a minimum of 25 people for 60 days or more a year. In addition, the plant must make an active effort to serve water which includes on of the following:

1. Having a drinking fountain.
2. Having a cup dispenser at a sink.
3. Any other means of serving the well water, like pitchers of ice water. (Note: Commercial bottled water does not apply).

REQUIREMENTS OF THE OWNER OF THE NONCOMMUNITY WATERWORKS

1. To conduct all bacteriological sampling of their own waterworks according to the Virginia Board of Health's Waterworks Regulations. At a minimum, this involves quarterly sampling.
2. To ensure samples are collected for the analysis of nitrates in the water once every five (5) years.
3. Ensure the receipt of necessary sample containers from DCLS.
4. In the case of either a monitoring violation, a bacteriological sample result violation, or a high nitrate concentration, it is the owner's responsibility to post a Public Notification alerting the public to the specific problem. The owner shall date and sign the notification and shall write a letter to DSS indicating that the notice was posted, the date of posting and a copy of the signed notice.

REQUIREMENTS OF SANITARIANS THAT INSPECT NONCOMMUNITY WATERWORKS PLANTS

1. Sanitarians are not to collect water samples for bacteriological analysis unless done as a special project approved by the area office supervisor.
2. In the event that positive tubes occur in samples at noncommunity supplies, the sanitarian shall make every effort to achieve correction of the problem just as would be done for private supplies or connections. The only difference will be that the owner of the noncommunity waterworks takes the samples and mails them to DCLS. The sanitarian shall use the tracking form for unsatisfactory water samples as is explained in Section 2.

3. On or about the 10th of the month following the quarter, the sanitarian is to determine compliance of his noncommunity waterworks. If there is a violation of either the monitoring (sampling) requirements, the Primary Maximum Contaminate Level (PMCL) (see 4.05 of the Waterworks Regulations), or of the allowable nitrate concentration (see 7.03.01 of PPI 6.28 - Noncommunity Waterworks Manual) the following action on the part of the sanitarian is required:
 - a. Confirm the analysis results or lack of reported results to ensure all sample results are in.
 - b. Send a letter to the owner of the waterworks notifying him of the specific regulation(s) violated. Include with the letter the appropriate Public Notification form for him to date, sign and post. The sanitarian shall fill out the other information on the form. If the owner will not sign and post the notice, the sanitarian may then do so. Indicate that the owner must post the Public Notification inside a protective covering conspicuously at all times and at all places where the water is made available to drink. The notice must remain posted until the violation ceases. In the case of a bacteriological monitoring violation, the violation period will cease when two check samples and one replacement sample show no contamination. In the case of a high nitrate concentration, the notice must indicate the fact that nitrate concentrations exceed 10mg/l and the potential health effects of exposure (see Sec. 8.02.03 of PPI - 6.28). Also indicate that the owner must write a letter back to DSS indicating that the notice was posted, the date it was posted, and a copy of the signed notice.
 - c. Fill out a PASSION report as per instructions in Appendix 9.14 of PPI 6.28.
 - d. On or about the 28th of the month following the quarter, add any more violations to the PASSION report and send it through the field director to the compliance officer of the Office of Water Programs in Richmond.
 - e. The sanitarian must ensure that notices are sent to owners and that corrective action is taken. The sanitarian must also ensure that the owner sends the letter to DSS indicating that the notice was posted, the date, and a copy of the notice. To help ensure that the owner undertakes the required actions, the sanitarian should send a registered letter with return receipt requested that states the owner's required action. This information shall be copied and mailed to the central office.
 - f. Accurate records of all violations must be kept and forwarded to the Area Office Supervisor at the end of each quarter.

4. If a system appears unsuitable because of fluctuating bacteriological quality and no known reason exists (e.g. such as work on pipes, well, etc.) then the procedure to determine whether a water supply can be used even with chlorination shall be employed (see Appendix A, Attached). This involves MPN analysis of 20 samples.
5. Once every 5 years the sanitarian is to take a water sample for nitrate analysis by DCLS and ensure that the waterworks owner is charged by DCLS for the analysis. Results of this analysis shall be forwarded to the central office. It is up to the sanitarian and the area office supervisor to track this sampling requirement.
6. The sanitarian is to take one historical water sample for complete inorganic analysis by DCLS. Results of this analysis shall be kept in the plant file and a copy forwarded to the central office.

SECTION 4 - NONTRANSIENT NONCOMMUNITY WATERWORKS

DESCRIPTION OF NONTRANSIENT NONCOMMUNITY WATERWORKS

To be a nontransient noncommunity well, a plant meets the same requirements as a noncommunity well (i.e. has its own well, employs a minimum of 25 people, makes an active effort to serve water) yet must work for 6 months or more per year (instead of only 60 days as for noncommunity).

REQUIREMENTS OF SANITARIANS THAT INSPECT NONTRANSIENT NONCOMMUNITY WATERWORKS PLANTS

1. The design and approval of these waterworks shall be conducted by the engineer in the OWP-DWSE responsible for the respective region.
2. The OWP-DWSE engineer is responsible to see that the plant's water supply remains satisfactory and that the water supply is properly sampled.
3. The sanitarian is responsible for forwarding any bacteriological results from OWP-DWSE to the central office. The sanitarian is also responsible for reviewing the bacteriological data received from OWP-DWSE to assure that the processing water meets sanitary requirements.

SECTION 5 - APPROVAL OF WELLS

Wells are to be constructed so as to meet noncommunity waterworks standards. (See Section 13 of the Waterworks Regulations). Additional information on well requirements can be found in the Board of Health's Waterworks Regulations, Sec. 8 (attached).

WELL LOT SITE SURVEY:

- 50 foot radius around well as a minimum lot size (100' x 100' square well lot is sufficient).
- No underground storage tanks on well lot.
- No above ground oil or gas tanks on well lot.
- No storage of chemicals on well lot.
- No septic tank drainfield, pit privies, etc. on well lot.
- No cemeteries on well lot.
- Surface drainage away from well head, grade if necessary, locate well on high spot.
- Paved parking lot on well lot is permissible if it is located away from the well and does not drain toward the well.
- Building can be over well, but chlordane cannot be used for termite protection, provided no point source contamination (i.e. sanitary sewer, drain lines etc. within 50').

WELL DESIGN:

- Class II A or B well type is applicable in Tidewater area.
- Cased and grouted to 50' minimum, 100' if near salt water.
- Plastic casing may be used but shall not exceed the maximum allowable depths shown in Working Memo #63, page 3. Proper types of pipe must be used as indicated in that working memo.
- Cement pad around well head, minimum of 3 foot radius, minimum 4" thick and sloped away from casing. (A 6' x 6' square form is usually the easiest shape).
- the top casing shall be above the 100 year flood plain, which may mean that in a flood prone or storm tide swept area the casing will have to protrude well above ground surface and be protected with rip rap, cement blocks, etc. to prevent accidental breakage.
- Mechanical sanitary seal is required on the top of the casing, any remaining holes to be plugged.
- U shaped vent through the sanitary seal with screen over it to prevent insect or rodent entry.
- An approved pitless adapter is suitable for use with metal or plastic pipe in an area with a high water table or adjacent to a tidal area.
- A single check valve in the line between the well and the plant shall be provided and is sufficient to protect the well. Additional backflow prevention devices may be needed

- as specified by local building officials and DSS.
- The sanitarian should try to intermittently visit the well site while the work is being drilled, especially when it is being grouted to confirm the work, though this is not required and may not be feasible in some instances.
- See appendix C. This should be used as a guide. Some parts may not be applicable to specific plants.

SAMPLING

- If the supply will be a noncommunity supply, the well driller must conduct a 48 hr. minimum yield and drawdown test. A 24 hr. yield and drawdown test will be considered upon request on a case basis since most wells will be in unconsolidated material in the coastal plain.
- The sanitarian shall need to obtain at least 9 consecutive negative samples collected 1/2 hour to 1 hour apart directly from the well before the well can be approved.
- If 9 consecutive negative water samples cannot be obtained, then conduct an MPN test using a total of 20 samples to determine if chlorination can be used. Groundwater containing total coliform concentrations of 100 or more organisms per 100 milliliters based on the geometric mean of 20 or more samples constitutes unacceptable contamination for disinfection treatment alone. consult with the DSS central office if this is the case. (See Appendix A, attached).
- Once the well has been approved, the lines in the plant need to be tested. Three negative samples taken on different days will be needed (because the piping may be contaminated). Disinfect the well and piping following instructions in Section 2 of this working memo prior to sampling from the plant water lines.
- If the plant will be a noncommunity supply, the sanitarian shall take one sample for complete inorganic analysis by DCLS which will include analysis for nitrate. Private supplies and connections do not need this analysis.

FINAL APPROVAL:

- The owner shall provide to the sanitarian a copy of the water well completion report; and the sanitarian shall submit a copy to the central office.
- The sanitarian shall draft a short memo indicating that the well is approved and why he believes it is satisfactory. A copy shall be kept in the area office plant file and a copy shall be mailed to the central office.

REC:RJW/teb

APPENDIX A

BACTERIOLOGICAL SAMPLING

To Determine the Need or Suitability for Chlorination

1. Collect nine (9) samples marked by the collector "MPN" in blanks 14-16 of the Bacteriological input form.* These samples must be taken no closer than 2 hours apart in order to spread sampling out over a reasonable period of time to get a representative sample of the water being delivered. These samples should be collected preferably on Monday, Tuesday and Wednesday and shipped so as to be received by the laboratory within 48 hours.
2. If any of the nine (9) samples show any positive results, an additional eleven (11) samples (for a total of 20) will be taken. If all 9 samples are good, sampling can be discontinued and the supply used without chlorination.
3. The 20 samples will be used to determine the geometric mean MPN.

- * Determination of coliform density by serial dilution and heterotrophic plate count is used in this test procedure. The standard MTF (Multiple Tube Fermentation) procedure is sensitive to low densities of coliforms, and is designed to give MPNs ranging from <1 to >23.0 coliforms per 100 mL. The serial dilution procedure is a test useful for determining the density of coliform contamination in samples that have levels of contamination higher than that which might be expected. The serial dilution procedure is designed to give MPNs ranging from <1.8 to >1600 coliforms per 100 mL.

The heterotrophic bacteria are not a health concern and have not a Maximum Contaminant Level. Sometimes heterotrophic bacteria grow so well they can interfere with the coliform test by competing with and smothering (or suppressing) the coliforms. Excessive heterotrophic bacterial growth is exhibited by a turbid culture tube with no gas production in the MTF procedure, confluent growth on membrane filters, or a turbid culture bottle with no color change in the Presence-Absence test.

The MTF procedure, using serial dilutions, and the heterotrophic plate count are recorded on the attached bench sheet.

APPENDIX A, Pg. 2

4. Geometric mean is defined as follows:

$$\text{Log } G = \frac{\sum_{i=1}^n \log X_i}{n}$$

Where **G** = **geometric mean**

X_i = **individual sample results**

n = **number of total samples**

5. Result interpretation

- If all results were negative, obviously there is no need for chlorination.
- If the geometric mean MPN of the 20 samples is less than or equal to 3, no chlorination will be required.
- If the geometric mean MPN of the 20 samples is greater than 3 but less than 100, chlorination will be required.
- If the geometric mean MPN of the 20 samples equals or exceeds 100, the source can not be used with only chlorination for treatment (reference Section 8.03 of the Waterworks Regulations).

6. An example is as follows:

Note: All results "<3" are entered as 1 for MPN analysis.

<u>Number of Samples (N)</u>	<u>MPN Result (X_i)</u>	<u>Log X_i</u>
1	1 (<3)	.000
2	4	.602
3	8	.903
4	1 (<3)	.000
5	3	.477
6	1 (<3)	.000
7	2	.301
8	3	.477
9	20	1.301
10	20	1.301
11	2	.301
12	4	.602

APPENDIX A, Pg. 3

13	5	.698
14	8	.903
15	10	1.000
16	11	1.041
17	12	1.079
18	4	.602
19	5	.698
20	4	<u>.602</u>
		<12.888

$$\text{Log } G = \frac{12.888}{20} = .6444$$

$$G = 4.4$$

therefore, chlorination would be required.

Initial Report of Unsatisfactory Result

Follow-up to Initial Unsatisfactory Result

[illegible]

Reasons for believing the potable water supply is now satisfactory:

Date _____

UNSATISFACTORY WATER SAMPLES
MASTER TRACKING FORM (OPTIONAL USE)

[illegible]